VOLUME 1, NUMBER 3 • MARCH 1966

PERT--PROJECT PLANNING AND CONTROL TOOL

Realistic Project Planning Aid . . . Pre-Evaluates Project Changes . . . Provides Up to Date Progress Reports . . . Spotlights Extra Work Time . . . Cuts Time and Cost . . . Allows Management by Exception . . .

Project planning need no longer be a haphazard process. As projects have become more complex and involve many interrelated functions and activities, management has required help in organizing its plans. PERT (Program Evaluation and Review Technique) was created to answer this important need for improved planning and control of complex programs. An example of such programs is the project for which PERT was born—the Polaris Missile System. Existing planning aids were insufficient to handle this project because of the complexity of the diverse tasks to be completed by many departments, so a Navy Operations Research team developed this new tool which enables management to plan, evaluate, and control complex programs.

WHY PERT

PERT offers many advantages to management, the most important of which is that it can shorten project completion time. It provides a means of finding the earliest realistic completion date and helps to complete the project by this date. Since time means money in most projects, PERT also reduces costs. PERT requires that all phases of a project be identified and that the completion date of each phase be estimated. This calls for detailed planning, and management is thereby assured that the project is being thoroughly analyzed. PERT is of particular value in keeping management up to date on the progress of a project. It provides a step-by-step ruler by which progress can be measured, thus forewarning management of any trouble before it develops. Moreover, PERT indicates when each task must start and end in order to meet a specified schedule, what tasks are performed concurrently, and the total time and money expected to be spent on the entire project. The extreme flexibility of PERT is a great aid in complex projects. As unforeseen developments arise which require a change in plans, it can judge the situation and provide a new course of action. It is also a guideline for measuring work adequacy. By comparing expected work to work actually performed, management can measure the efficiency with which each part of the project was completed and can use this information in planning the next project. PERT enables management to pretest decisions and examine their effect on the project before money and manpower are committed. This tool is beneficial to both labor and management because it enables companies to organize sounder hiring and layoff policies. The company has a clear picture of when the manpower will be needed so that it will find itself neither shorthanded nor excessively staffed. It is also a boon to labor in that the company knows far in advance that a job is terminating so that the employees can be given proper notification or be re-trained. PERT enables management to see both an overall picture of a complex project and a detailed view of any part of the project, while encouraging periodic re-evaluation of progress in time and/or cost.

WHERE PERT IS USED

The many different types of management projects in which PERT can be used to cut costs and manpower needs range from home building to motion picture production. It is becoming increasingly popular for the installation of computers. When a computer is installed in a central data processing center, the variety of tasks and their interrelationships creates a need for this planning aid. The sequence of tasks such as the selection of machines and site, staff selection and training, programming, program testing, and the establishment of forms and services, must be carefully planned so that each job will be finished by the time the data center is scheduled to open.

EDP NEWSLETTER
ELECTRONIC DATA PROCESSING NEWSLETTER
RESEARCH APPLICATIONS INC.
300 EAST 44TH STREET, NEW YORK N.Y. 10017

Probably the most widespread use of PERT is in construction. Since most projects in this field involve subcontractors, time limits, and the problem of having many interrelated tasks going on simultaneously, it is natural that contractors should find a "right hand man" in PERT. As management is becoming aware of the tremendous potential of PERT, more and more applications are being found in various fields. Economic planning, maintenance planning, marketing, advertising, public relations programs, play production, political campaigns, training programs, mergers and consolidations, administrative planning, and report preparation are only a few of the virtually unlimited commercial applications being developed.

HOW PERT WORKS

The foundation of the PERT approach is the *network*. It is a diagram of the steps necessary to complete the project. The steps are arranged in a logical sequence, showing the relationship of each step to each other step. The network is made up of *events* and *activities*.

An *event* is a point in time—the beginning or end of a specific task. It can mark an objective, an actual accomplishment, or a decision point.

An *activity* is the work which must be completed between two consecutive events. An *activity* cannot begin until the previous event has taken place and it must be accomplished before the following event can occur.

This diagram of events and activities allows management to see the relationships between each task in the project. In Figure 1 on the following page, it can be seen that activities "f" and "g" must be completed before event 7 can take place. These relationships are the heart of PERT, because from this network the managers of activities "f" and "g" can see that they must coordinate their work in order that no time is wasted between the completion of activity "g" and the beginning of event 7.

The object of the network is to show the entire project as a series of events connected by activities so that management gains an overall view of the interrelationships between each phase of the project. This allows every manager to see how his job fits into the project as a whole and allows the project coordinator to see what each part of the project should be doing at any point in time.

A network contains many paths, or ways of starting at the first event and completing each sequential event and activity which must be accomplished before concluding the project. Work may be carried out along each path, separately and concurrently. In the elementary network shown in Figure 2, there are 3 paths. Path #1 includes events 1, 2, 3, 4, 7 & 8. The man responsible for each activity must determine approximately how much time and/or money it will take to complete his job. Once the activities are converted into time and money, a significant difference exists between the network paths from management's standpoint. In order to reduce the total time or cost of the project, the longest path through the network must be shortened. It governs the length of the entire project and is therefore known as the *critical path*. The critical, or longest, path in Figure 2 is path #1. Since path #2 only takes 18 weeks, it is 8 weeks shorter than the critical path, or has 8 weeks *slack time*. This knowledge would allow the contractor to take workers from the second path and put them to work on the critical path to speed its completion, and therefore speed the completion of the entire project. For example, workers from activity "g" (Affix Exterior Trim) could help with activity "f" (Interior Carpentry) after completing their activity, thereby reducing the overall project time by using slack path resources to shorten an activity on the critical path.

This is, basically, how PERT works. By estimating the time and/or cost of each path, it shows management which path must be shortened to speed completion of the project, while pointing out the shorter paths from which men and resources may be borrowed.

These sample networks give only a very broad view of the project. Since all projects have their "trouble spots", PERT makes it possible for management to give special attention to these difficult or time consuming parts by requiring them to be extremely detailed in the network. For example, if our contractor knows he is going to have difficulty laying the foundation for this house, he will divide this section of the network into many activities and events such as "excavate" and "mix cement" in order to more carefully plan and control this part of the construction.

HOW COMPUTERS HELP

Computers make it possible for management to keep up to date on the progress of their projects. Calculations that would take humans weeks to perform can be processed on a computer in minutes. This means that the networks can undergo periodic re-evaluation and that any new developments can be immediately treated. Computerizing PERT makes it possible to have more detailed networks and therefore more thoroughly planned projects. The networks used as examples on the following page are very simplified—a real network can have hundreds of activities. The calculations required to process such networks would completely overwhelm anyone trying to do the job manually.

The number of PERT applications has grown phenomenally since its introduction in 1958. A list of users reads like a "Who's Who" of industry. Both large and small firms have credited it with saving time and money, not to mention managerial wear and tear, and would never go back to old-fashioned manual project planning.

Lest we give the impression that PERT is a panacea for all problems, please remember that it is only as reliable as the information given it. Its value depends upon an educated management who can supply realistic time and/or cost estimates. It is not a substitute for good management, but a computational aid which, when used effectively, can save both time and money.

SAMPLE NETWORK FOR BUILDING A HOUSE

Figure 1

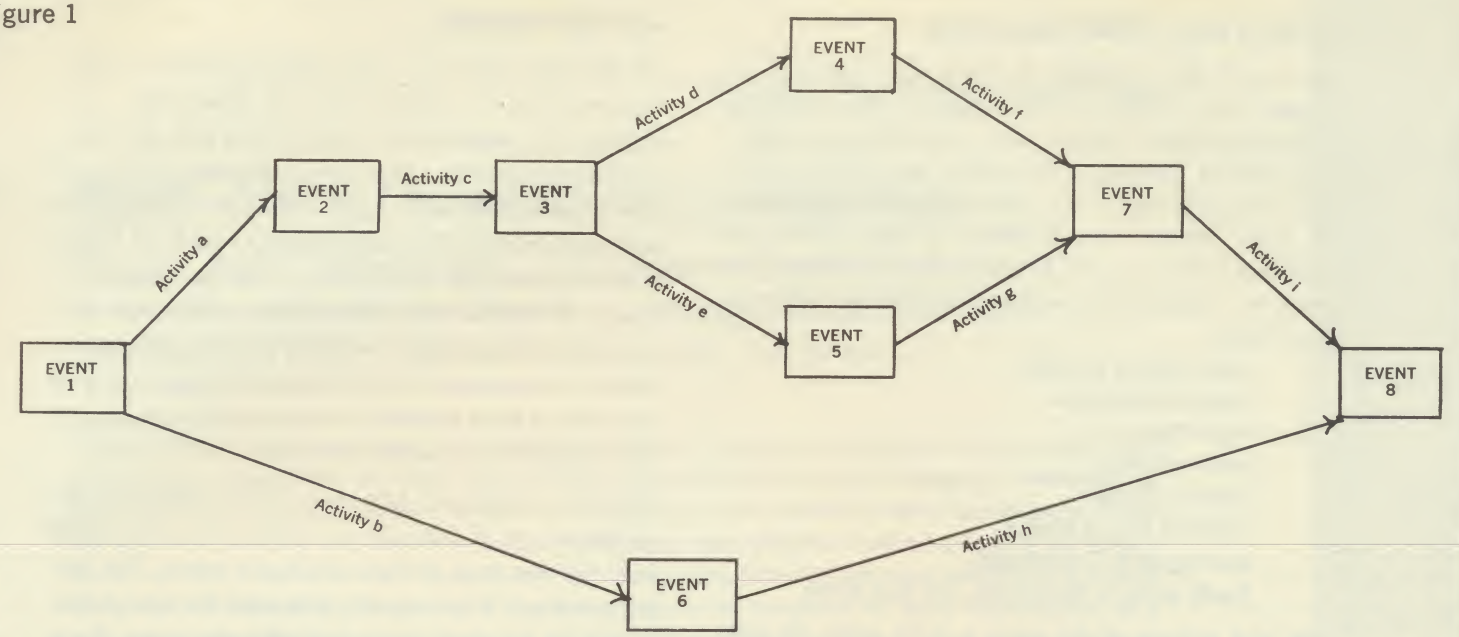
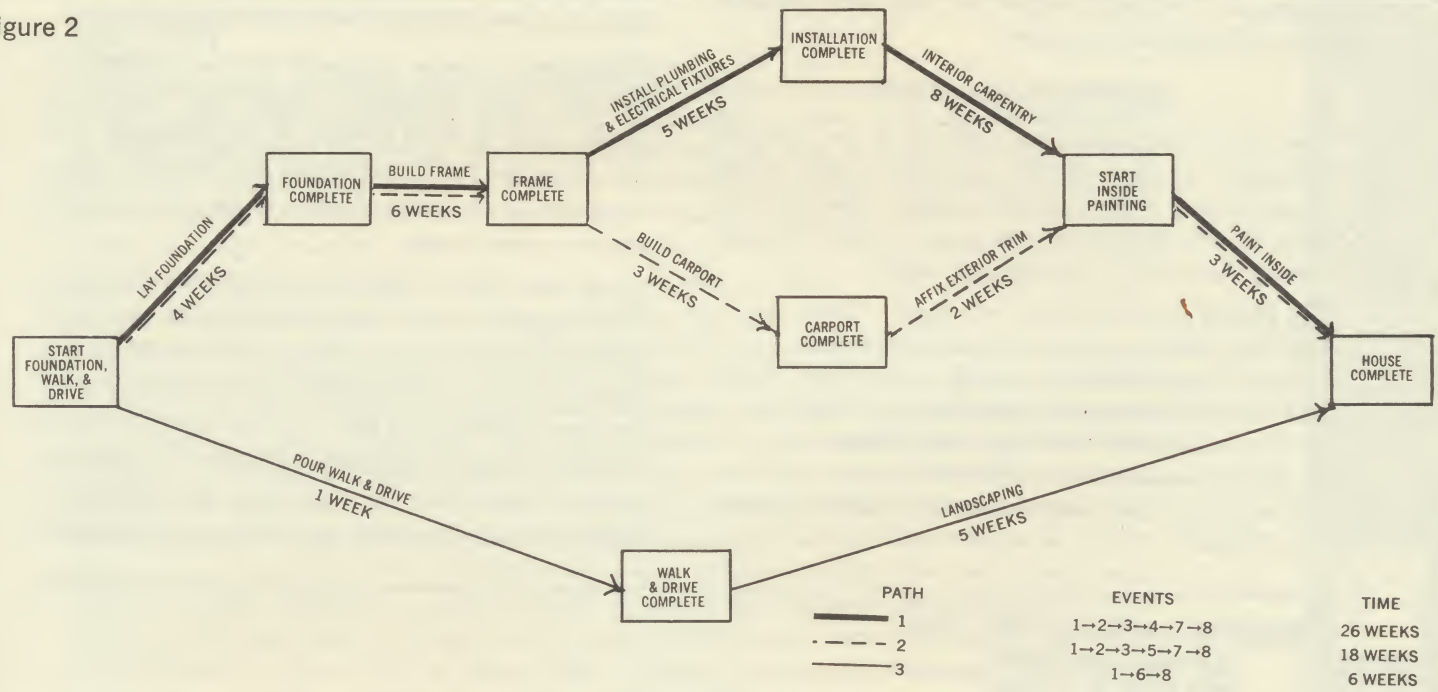


Figure 2



If you would like to have your name added to our mailing list, please complete the following form and return it to us.

NAME _____

TITLE _____

COMPANY NAME _____

ADDRESS _____

CITY, STATE _____

TYPE OF BUSINESS _____

DO YOU CONTRACT FOR DATA PROCESSING SERVICES? _____

TYPE OF COMPUTERS YOU OWN OR RENT _____

ALWAYS MEET YOUR CHALLENGE . . .

We would like to thank all those who wrote us or dropped by to show us their solution to the Traveling Salesman Problem. We had many enthusiastic and sometimes heated discussions throughout our offices and it was very gratifying to see that our problem generated so much interest. As promised, we now reveal the optimum solution to our European Tour Problem. The route our hypothetical vacationer should have taken is to go from:

New York to London,
then to Amsterdam,
on to Paris,
next to Zurich,
a stop at Rome,
stopping next at Venice,
moving on to Copenhagen,
finally going to Stockholm, and then home.

The total mileage of this route is 9,751 miles. To help those of you who arrived at the correct solution retain your current hat size, may we just add that it took our computer 17 seconds to digest the facts, solve the problem, and print out the answer.

JUST FOR THE FUN OF IT

Because of the enthusiastic response to our previous challenge, we have decided to include a little mental exercise as a regular monthly feature. "Just For The Fun Of It" will pose a brain teaser in each issue and supply the answer in the following issue.

All Droons are the same size and shape.
All Green Slackens are the same size and shape.
Twenty Droons just fill a Muldruff.
All Wallaxes contain Green Slackens.
A Green Slacken is 10% bigger than a Droon.
A Wallax is smaller than a Muldruff.
What is the largest possible number of Green Slackens in a Wallax?

ALL FAIR WARNING . . .

It's that time of the year again, and as people are laboring over their tax returns they are faced with a new problem—the computer has joined forces with the Internal Revenue Service. This data processing service will handle more than half of the 104 million tax returns to be processed in 1966 (representing about $118 billion in tax revenue) and by next year it will be equipped to handle all returns filed. Many gladly accept this new service for it means faster refunds, but for a great many others (a sampling of several thousand taxpayers proved that 59% of them paid less than they owed) it represents the closing of tax collection loopholes.

Until now, examiners have been able to check all the arithmetic on all business tax forms, but could check only the first page of the individual's return. The taxpayer was safe if he correctly subtracted his total deductions from his total income and used the proper figure from the tax table for his calculations. Any further fabrications could be safely employed, as only one in 20 forms was ever examined further than the front page.

Computers will make it possible for the arithmetic to be much more thoroughly checked and certain key entries (such as credit claimed for tax payments) verified. They also foil the individual who files two returns in order to get a double refund, and the one who dares to file no return at all.

Uncle Sam will be approximately $5 billion richer in 1966 because of the elimination of these and many other tax loopholes. It is estimated that he will also save some $50 million a year in IRS employee salaries as the previous workforce has been cut from 12,000 to 1,800. Exactly how much of this can be attributed to computerization is not known, but it is safe to say that the $17 million spent on this system so far was a wise investment.

RESEARCH APPLICATIONS, INC.
300 EAST 44th STREET
NEW YORK, N. Y. 10017
ATT.: EDP NEWSLETTER EDITOR